Oxidative Damage and Aging: Characterization of Novel Helicases DinG and YoaA and Catalases KatE/KatG, and Their Effects in Cellular Defense Against Reactive Oxygen Species

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Oxidative damage in the genome occurs when reactive oxygen species (ROS), a byproduct of metabolism or from exogenous sources, come in contact with DNA. This has been suggested to play a role in aging and cancer. Evidence suggests that Escherichia coli respond to oxidative stress by inducing the expression of DNA repair enzymes and ROS scavengers. However, the specific roles of these proteins in survival following oxidative damage remain poorly characterized. This study aims to elucidate the effects of two classes of genes proposed to be involved in cellular damage against ROS: the putative repair helicases DinG and YoaA and the scavenging proteins catalase-peroxidase KatE and KatG. To address the role of these proteins, E.coli mutants in each of these genes were constructed and exposed to the oxidant hydrogen peroxide. Contrary to the original hypothesis, the absence of DinG and YoaA showed no significant impact on cell survival following hydrogen peroxide induction of oxidative damage. Additionally, combining either the DinG or YoaA mutation with a mutant in Exonuclease III (xthA gene product), a base excision repair enzyme that removes oxidized bases, had no effect on cell viability after oxidative challenge compared to the xthA single mutant, suggesting that these proteins do not have a role in survival following oxidative damage. Cell viability following oxidative challenge was also independent of KatE and KatG expression at high concentrations of hydrogen peroxide (10 mM). However, preliminary studies suggest a role for KatE and KatG at low concentrations of this oxidant (1 mM). Potential mechanisms for these results are discussed.

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